

Introduction

American alligator courtship occur April-May when males attract mates by performing behavioral displays that vibrate the water with low frequency sounds, bellowing, and releasing lipid-rich exocrine secretions from paracloacal glands into surrounding waters. Subsequently, copulation occurs underwater with males everting a phallus for female cloaca intromission (Fig. 1).

Paracloacal glands

- Embedded in the lateral proctodeal walls
- Produces pheromonal exocrine secretions of lipid materials with pale brown color, musky odor associated with male territoriality during breeding season
- Currently holds no recognized functional association with copulatory performance

Phallus

- Stored within the cloaca until compression via levator cloacae muscles
- Pressure pushes phallus through the distal end of vent, pivoting on the ventral tendon and placing the ligamentum rami under tension
- This position is held until copulation completes, muscles relax, and the phallus withdraws into the proctodeum due to ligamentum rami tension.

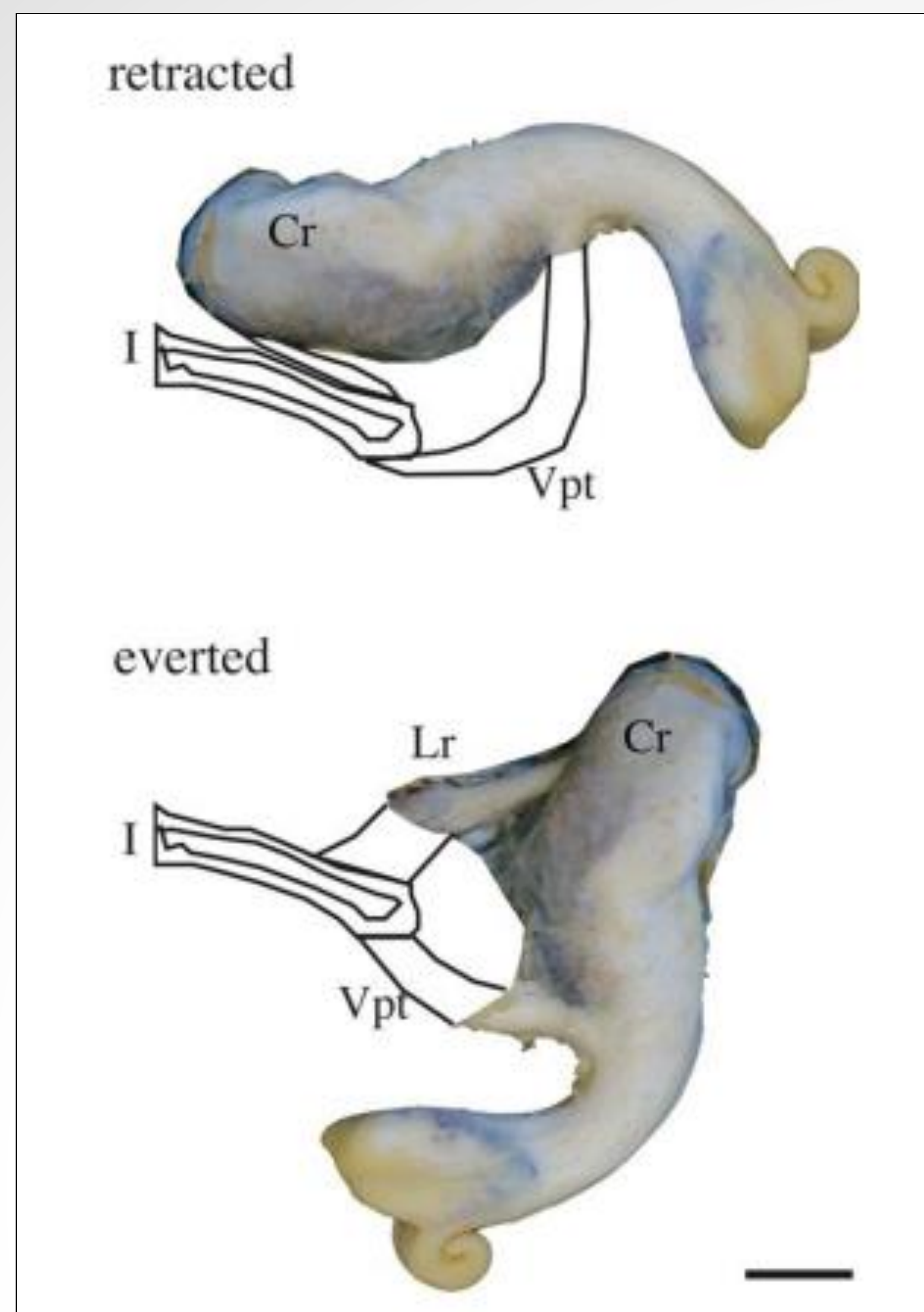


Figure 1: Alligator phallic eversion mechanism, Kelly, 2013. Cloacal muscle contractions move the phallus from the cloacal while pivoting the shaft ~90 degrees so the distal tip points cranially. Phallic cruae (Cr), ischium (I), ventral penile tendon (Vt).

Objectives

- Here we present an anatomical characterization a novel fibrous tissue connection between the phallic shaft and paracloacal glands.

Methodology

Gross Dissection

- Four adult male alligators were collected from Merritt Island National Wildlife Refuge (MINWR), Florida and necropsied for cloacal tissues
- All animal care and use was performed in accordance with the University of Florida Institutional Animal Care and Use Committee (IACUC) under Protocol No. 201005071 and IACUC GRD-06-044. Samples were collected under MINWR permit 2006 SUP 55 and permits from the Florida Fish and Wildlife Conservation Commission and U.S. Fish and Wildlife Service.

Three-dimensional Reconstruction

- Cloacae were imaging in a Bruker Biospec MRI scanner using a 72 mm diameter Bruker volume RF coil and a 3D-FLASH sequence (T/TR/Flip/ NA = 6.5 ms/25 ms/14 /2) and a total scan time ~ 2 hr.
- Slicer program [slicer.org] was used to 3D reconstruct internal tissues from MRI stacks (Fedorov A. et al. PMID: 22770690. PMCID: PMC3466397.)

Results

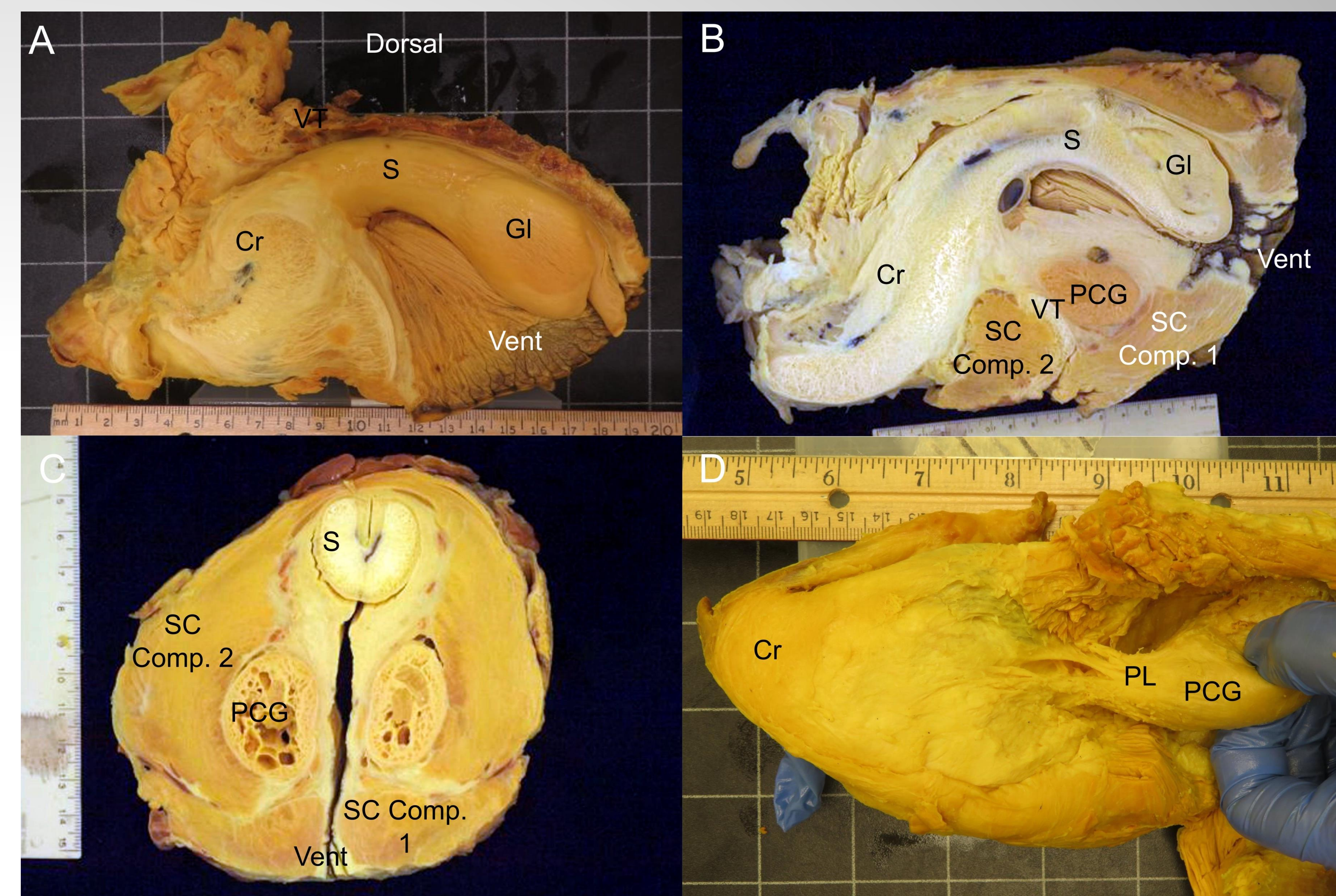


Figure 2: Male alligator cloaca: A,B) Sagittal sections, C) Transverse section, D) Phallus to paracloacal gland connection. Cr: crua, S: shaft, GI: glans, PCG: paracloacal gland, MGL, PL: paracloacal gland ligament, SC comp. 1&2: sphincter cloaca muscle complexes Images

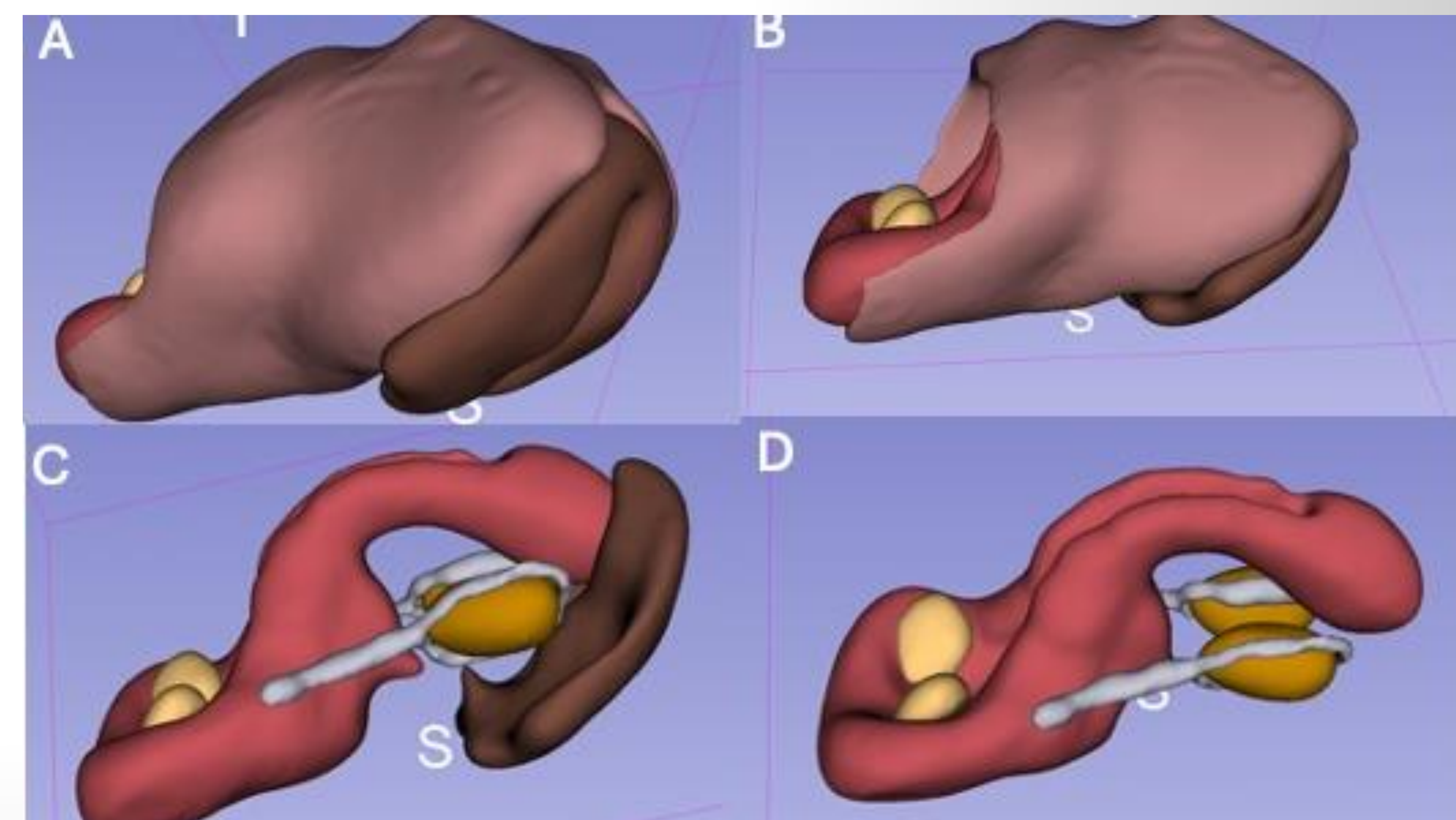


Figure 3: Three-dimensional reconstruction of gross dissection.

Phallus Paracloacal Glands Supra crua plexus PL SC1 SC2

Conclusions

- Rotation of the phallic shaft during eversion applies tension on the paracloacal ligament that, in turn, applies compressive tension to the gland's tunic. Functionally, this could result in glandular secretions during male copulatory function- a novel function.
- Further *in vivo* studies are needed to support the proposed reproductive function inferred from this anatomical relationship.

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